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AUTHOR Marr, Mary Beth
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ABSTRACT

With the use of verbal report strategies, a study was conducted to examine (1) the types of comprehension strategies readers use to process familiar and less familiar texts and (2) the differential use of think aloud strategies by average and below average readers. Subjects were 15 tenth grade male students in upstate New York. Two weeks prior to testing, students were given a 50-item completion test assessing their knowledge of American football and rugby union. After two practice sessions were completed, subjects were told to begin reading the test passage on football and rugby and to stop when they came to a pause signal. At this point, they were asked to briefly summarize what they had read so far and to state what they were thinking or doing as they read to comprehend that portion of text. They were also asked specific probe questions to identify the use of problem solving strategies. Findings indicated that the more knowledge subjects had about a topic, the more they evaluated what they were reading, drew inferences, and made direct comparisons between familiar and less familiar passages. Students with below average comprehension ability evidenced a greater number of errors in recalling the content of the passages, made fewer evaluative comments, and drew fewer inferences while reading less familiar passages than their average classmates. (A copy of one text passage is appended.) (HOD)

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VERBAL REPORTS: HOW READERS PROCESS UNFAMILIAR TEXT

Mary Beth Marr
Assistant Rpofessor
Department of Reading - LCB 30
SUNY- Albany
Albany, N.Y. 12222

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** This study should be regarded as a preliminary investigation. Subsequent data collection is planned to extend these findings.

Verbal Reports: How Readers Process Unfamiliar Text

Introduction

During the past several years researchers have examined the effects of prior knowledge on the comprehension of text (e.g. Brown, Smiley, Day, Townsend & Lawton, 1977; Marr & Gormley, 1982; Pearson, Hansen & Gordon, 1979; Taylor, 1979). These studies demonstrated that individuals access prior knowledge and experiences to interpret text, and further, that this knowledge influences the amount and type of information extracted. Researchers have also found that by providing students with information about an unfamiliar topic (cricket) and/or by drawing comparisons between familiar and unfamiliar topics (cricket and baseball), understanding and learning of the new information was increased (Hayes & Tierney, 1982). All of these studies lend support to theories of the comprehension process which suggest that a higher order conceptual framework (Schema) is used to interpret and comprehend text.

Concurrently, researchers have become increasingly interested in the strategies readers use to comprehend text. In an effort to examine the processing strategies readers utilize while reading, Olshavsky (1976-1977) introduced the use of think-aloud tasks. She patterned her study after the work of Newell and Simon (1972) on problem solving strategies. Olshavsky found that good readers apply the problem-solving strategies more frequently than poor readers and that both interest in the topic to be read and abstract writing style increase the use of problem-solving strategies during the comprehension process. Although the use of verbal reports as an index of cognitive processing has received a great deal of criticism historically and quite recently (see Garner, 1982, for a discussion of these issues), Ericsson and Simon (1980) argue quite convincingly that on-line verbal reports which minimize the interval between processing and reporting provide a viable data-base of cognitive processes used to solve problems or comprehend what is read. As a result, reading research has begun to reflect this methodology. Garner (1982) asked students to read and summarize an expository text. She found that there were a greater number of "cognitive events" or strategies reported in the same day treatment group as compared with the delay treatment group. She posits that the thoroughness of a verbal report seems to depend to some extent on the recency of the activity, lending support to the position taken by Ericsson and Simon. Following a similar methodology, Hare and Smith (1982) asked students to read expository and narrative selections, pause at various points in the passage and think-aloud describing their comprehension strategies. They found when achievement test scores were correlated with response types, the total unique number of strategies elicited from the expository passage

was negatively correlated with reading achievement and unrelated to those responses elicited from the narrative passage. Rereading and imaging were frequently cited strategies when reading the narrative passage,and rereading and changing speeds frequentl cited for the expository passage.

Based on these more recent studies which utilized the verbal report strategy, it was felt that the think-aloud task may provide viable information regarding the processing of familiar and less familiar text. Thus, the purpose of the present study was to extend the existing research examining prior knowledge and reading comprehension to include a verbal report strategy which might provide new information regarding: 1) the types of comprehension strategies reader's use to process familiar and less familiar texts and 2) differential use of these think-aloud strategies by average and below average readers.

Method

Subjects.

Fifteen male tenth-grade students from a High School in upstate New York were selected for participation in the study. Nine students had above average comprehension skills and six below average comprehension skills. Reading Ability was determined by their performance on the California Achievement Test (1977). Teacher judgment was used to confirm this reading ability placement. At the outset of the study, twenty subjects participated, however, due to difficulties with the taping equipment protocols from five of the subjects were inaudible and thus not used.

Materials

Two passages adapted from the Webster's Sports Dictionary (1976) were constructed each containing approximately 327 words, similar sentence structures, and an equivalent number of idea units (Kintsch, 1974). After the passages were constructed the Dale-Chall (1948) readability formula was employed to derive a readability estimate and Degrees of Reading Power (DRP) estimate for the two passages. Each passage corresponded to a 7-8 readability index and 55 DRP units, commesurate with the students' placement on the DRP test (1980). The passages were expository in nature and described the sports of American football and rugby union (see the appendix).

Procedure

Prior Knowledge Pretest. Two weeks prior to testing students were given a 50 item completion test assessing their knowledge of American football and rugby union. The test assessed four levels of knowledge concerning the goal structure of each game.

These levels were derived from the work of Spilich, Vesonder, Chiesi and Voss (1979) which has shown that the type of knowledge a person has about a topic will influence his/her ability to recall information, integrate and elaborate upon ideas presented in the text. Thus, it was felt the type of prior knowledge the subjects have about a particular topic might influence the type of problem-solving strategy used in the comprehension of the passages. Hence, the pretest assessed knowledge of : Level #1 - the object of the game; Level #2 - scoring points; Level #3 - advancing players (to score); and Level #4 - game actions which facilitate level #3, for both sports.

Test items consisted of terminology, rules of the game and situations of play each corresponding to the four levels of knowledge above.

Training Session. Immediately prior to testing students were given a practice session to familiarize them with the think-aloud task. Two practice passages were constructed; adapted from the Webster's Sports Dictionary, they were structurally equivalent to the test passages and described the sports of soccer and cricket. In this manner, the practice and test passages were similar with regard to text structure and varying degrees of familiarity. Formal testing began when the subjects completed the two practice passages, were talking freely, and expressed a readiness to begin formal testing.

Testing. Subjects were tested individually. They were told to begin reading the test passage silently and to stop when they came to a red dot, a pause signal to think-aloud. At this signal they were asked to: 1) briefly summarize what they had read so far and 2) state what they were thinking or doing as they read to comprehend that portion of the text. Subjects were asked to continue reading and thinking aloud at each of the pause points until the passage was finished. Each passage contained 12 pausal points placed at the end of each topic in the passage (e.g. object of the game, scoring a touchdown, defensive players etc.) Each subject read both passages in one of two orders (football-rugby, or vice versa). In this manner, response patterns which might surface could not be attributed to a fixed order of reading the passages.

After the two test passages were read, specific probe questions were asked to identify the use of problem-solving strategies which may have been used, but were not reported previously. Testing time was approximately 45 minutes for each student.

Scoring. Subjects verbalizations were tape recorded and transcribed. These transcriptions were then matched with the text and responses classified into categories

developed by Olshavsky (1976-1977) and Hare and Smith (1982). New categories were created as needed to interpret the transcriptions. Subjects' responses fell into three general categories based on the testing task. The first category was labeled summary responses; these were the responses students gave when asked to briefly summarize what they had read thus far. The second category was labeled metacognitive responses; these included responses which reflected the students use of specific strategies to comprehend the text, make comparisons, identify a personal experience similar to the information in the text, image, etc. The third category was labeled probe metacognitive responses. This category included the responses students gave when asked questions about their use of a particular comprehension strategy such as rereading, imaging, predicting meaning etc. Response categories are listed in the appendix. There were 24 opportunities to report one or more of these strategies (12 pausal units per passage); the raw number of responses was tallied for each subject and used in the data analysis.

Design and Analysis

The design for the study was 2 (reading ability) x 2 (passage) factorial. T-tests were used to make comparisons between the two reader groups with regard to prior knowledge of the sports and response types. Step-wise regression analyses were also used to determine the influence of levels of prior knowledge on the type of response elicited from the passage.

RESULTS

Reader Group Differences

T-test comparisons were made between the two reader groups with regard to the total number of summary and metacognitive responses elicited from the passages. These tests revealed no significant differences between the two reader groups. Good readers reported an average of 4.90 summary responses (s.d. = 3.10) to the poor reader group's average of 2.83 (s.d. = 2.93). Metacognitive responses averaged 7.40 (s.d.= 2.68) for the good readers and 5.17 (s.d. 4.83) for the poor readers. When responses within each of the two categories were examined, T-test comparisons were non-significant, however, patterns of differences were beginning to emerge. Reader groups differed with regard to the error statements elicited from the football, $X_g = .40$, $X_p = 1.77$ and rugby passages, $X_g = .89$, $X_p = 3.43$. They also differed in terms of the number of evaluative statements about football, $X_g = 1.60$, $X_p = .17$ and the number ofinferences elicited from the rubgy passage, $X_g = 1.89$, $X_p = .57$.

One possible explanation for the lack of significant differences between these two reader groups is that the sample size is limited (N= 15).

Passage Differences

A second series of comparisons were made examining the prior knowledge scores and responses across the football and rugby passages. As expected, the students knew more about the sport football (X= 14.44) than rugby (X=4.54), $t_{(28)} = 5.09$, $p < .001$. There were also more total metacognitive statements elicited from the rugby passage ($X_r = 9.93$ versus $X_f = 6.53$), $t_{(28)} = -2.09$, $p < .05$. This finding was not surprising when one considers that a person is usually much more aware of the comprehension strategies they are using when the material is difficult or unfamiliar. Likewise , it is difficult to monitor comprehension strategies when much of the processing is occurring at a below-conscious level while reading familiar material (Cavanaugh & Perlmutter, 1982). Another difference between the two passages surfaced when the students were reading the rugby passage. A greater number of comparisons (rugby to football) were noted (X = 3.20) than were present when the football passage was read (X = .67), $t_{(28)} = -2.94$, $p < .05$. This pattern of response provides evidence that one attempts to understand the less familiar or new through comparisons with a known topic. A pattern consistent with the current theories of the comprehension process.

Prior Knowledge

Of major interest was the extent to which prior knowledge of the topics would influence the type of think-aloud strategy elicited from the passages. To examine the influence of this variable, a series of step-wise regression analyses were conducted. The results from this analysis are reported in Tables 1 and 2. At the outset of the study there were four levels of knowledge which comprised the total prior knowledge score. A series of regression analyses revealed that these individual levels of knowledge did not serve as significant predictors of the response types. Thus, these knowledge levels were collapsed to form a total prior knowledge score for each sport and used in subsequent regression analyses.

---- insert Table 1 ----

An examination of Table 1 reveals that students' knowledge of football was a significant predictor of their ability to make evaluative statements about the football passage, $F(1,7) = 21.26$, $p < .01$, accounting for 47.79% of the total variance. This finding suggests that prior knowledge of a topic is a critical variable if the students are going to evaluate what is read rather than merely assimilate the information and try to retain it in memory. Prior knowledge of football also served as a significant predictor of the students' ability to infer information from the rugby passage, $F(1,7) = 17.29$, $p < .01$, accounting for 61.74% of the total variance. Thus it appears as though students' ability to interpret a less familiar topic beyond a literal level depends in large part on their knowledge of a similar topic and their ability to establish the similarities between the two topics. Lastly, looking at Table 2, prior knolwedge of football served as a strong predictor of the students' reported use of a comparison strategy to facilitate the processing of the two passages, $F(1,10) = 6.12$, $p < .05$, accounting for 30.43% of the total variance.

---- insert Table 2 ----

Of particular interest was the finding that knowledge of rugby did not serve as a significant predictor of either summary or metacognitive responses elicited from the rugby passages. This lack of significance may be due in part to the students' limited knowledge of rugby as evidenced by their pretest scores.

DISCUSSION AND CONCLUSION

The verbal report methodology appears to be a useful technique to examine the processing strategies readers use to comprehend familiar and less familiar text. While the results from this study are preliminary in nature due to the limited sample size, these findings lend support to current schema-theoretic views of the comprehension process.

Readers did use prior knowledge to comprehend the passages. In particular, the more knowledge a subject had about a topic the more inclined he became to evaluate what he was reading, draw inferences between ideas of less familiar content, and make direct comparisons between familiar and less familiar passages. In addition students with below average comprehension ability evidenced a greater number of errors in recalling the content of the passages, made fewer evaluative statements about the familiar content, and drew fewer inferences while comprehending the less familiar passage than their average classmates.

These latter findings lend support to the notion that in addition to the importance of prior knowledge in comprehension, readers need to be taught specific strategies for comprehending text (Collins & Smith, 1980), strategies which proficient readers seem to acquire almost intuitively. Readers in this below average group appeared easily frustrated when they encountered comprehension difficulties, and perhaps most important, they appeared unaware of strategies such as rereading and imaging which could be used to facilitate comprehension.

In addition to these preliminary findings, this study also raises several concerns. To what extent were students cued to report only certain types of processing strategies in the think aloud training tasks (Cavanaugh & Perlmutter, 1982) . How might the training tasks be less obtrusive yet assist the subject in gaining access to cognitive processes which can be verbalized. Also, how does one quantify response types. In this study, there were 24 opportunities for both summary and metacognitive responses to be elicited. By the nature of the response types (e.g. draw inference, state failure to understand a clause) not all responses would be reported at each pausal point throughtout the passage. Perhaps the optimal scoring strategy would be to predict the likely occurrance of each of these responses at each point and weight the occurrance accordingly. Thus, transformed scores rather than raw scores could be used in the data analysis. Lastly, might the results from undirected probe questions prove to be more representative of the student's cognitive processing than directed probe questions which ask if a particular type of strategy was used to comprehend the passages. Perhaps the undirected probe question (e.g. Can you think back to any strategies you may have used?) might more aptly reflects the student's "true" cognitive strategy, although retrospective, rather than their perception of what they ought to report.

Subsequent research is presently being planned to address some of the concerns expressed above and to examine in detail the relationship between levels of prior knwoledge and specific response types.

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Table 1

Partitioning of the Prior Knowledge Variable Across Response Types and Tests of Significance

			Prior Knowledge			
			Football		Rugby	
Response Type	X	SD	F	Percentage of Variance	F	Percentage of Variance
Summary (Football)						
Add Information	2.0	1.77	3.47	7.79		
Infer Information	1.0	1.77	3.73	8.36		
State Error	.87	1.18	.36	.82		
Metacognitive						
Compare to Rugby	.67	1.23	5.12	11.50		
Iden. Personal Experience	1.67	2.47	2.65	5.96		
Image	1.33	1.84	.97	2.17		
Eval. Statements	.60	.98	21.26**	47.70		
DF Error = 7, R^2 = .843						
Summary (Rugby)						
Add Information	.53	.92	2.18	7.79	2.69	19.18
Infer Information	1.40	1.55	17.29**	61.74	1.81	12.90
State Error	1.87	2.53	------	------	.11	.78
Metacognitive						
Compare to Football	3.20	3.10	.05	.19	.89	6.35
Iden. Personal Experience	.40	.74	.13	.48	.47	3.35
Image	1.13	1.77	.18	.63	.99	7.07
Eval. Statements	1.00	2.24	.17	.61	.07	.49
DF Error = 7, R^2_F = .714 R^2_R = .701						

* $p < .05$
** $p < .01$

Table 2

Partitioning of the Prior Knowledge Variable Across Response Types and Tests of Significance

			Prior Knowledge			
			Football		Rugby	
Response Type	X	SD	F	Percentage of Variance	F	Percentage of Variance
Probed Metacognitive						
Compare Football & Rugby	.40	.51	6.12*	30.43	2.08	14.35
Reread	.53	.52	2.13	10.58	2.81	19.48
Text Organization	.27	.46	1.42	7.07	.04	.30
Predict Meaning	.53	.52	.44	2.19	.28	1.90

DF Error = 17, R^2_F = .503 R^2_R = .447

* $p < .05$
** $p < .01$

TEST PASSAGE

FOOTBALL

Football is a game played between two teams of 11 players each. It is played on a large rectangular field with goal posts at each end. The object of the game is to run, pass, or kick the ball across the opponent's goal line for a score.

Play is started by one team kicking the ball to the other. Subsequent play is started from the line of scrimmage, the point at which the ballcarrier was tackled. Even though the game is called football, kicking plays a minor role other than in attempting a field goal or point after a touchdown. Play is not continuous. It stops whenever the ballcarrier is tackled, when a pass is incomplete, or after a score is made. Each side is given four chances or downs to advance the ball for a gain of 10 yards. If they are unable to make that gain, the ball is given to the other side. Defensive players may tackle the ballcarrier and may shove players out of the way to get to him. Offensive players are permitted to block their opponents, but may not use their hands to keep players away from the ballcarrier or the passer. Any offensive player may run with the ball, but only the ends and backs are eligible to catch a forward pass. Although tackling, shoving and blocking are normally permitted, unusually rough play and illegal use of hands are fouls usually penalized by a loss of 5, 10, or 15 yards.

When a team carries or passes the ball over the goal line, it scores a touchdown worth 6 points and has an opportunity to kick the ball over the crossbar or carry it over the goal line for extra points. A field goal, a kick over the crossbar other than after a touchdown, is worth 3 points. The game is played in four 15 minute quarters. The team with the highest score at the end of the playing time wins.